DIGITAL DC TO DAYLIGHT

2011 Communications Academy
Digital Track - Talk 5

D-Star and D-Rats – The Perfect and the Good Emergency Communication Capabilities, Add-On Software and “Non-Icom Options”

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D-STAR
Digital Smart Technology for Amateur Radio

What is D-STAR?

- D-STAR is an open worldwide standard for digital communications over Amateur Radio
- The D-STAR standard was developed by the Japan Amateur Radio League (JARL)
- D-STAR uses the AMBE vocoder chip under license from DVSI
- Icom is initial Amateur Radio manufacturer of mobiles, HTs, repeaters and controllers
- Non-Icom repeaters are in operation

How D-STAR Works

- D-STAR is digital modulation
- Voice is converted from analog to digital for transmission
- Data is combined with digitized voice for transmission at 4800 bps
  - 2400 bits for Voice
  - 1200 bits for Forward Error Correction
  - 1200 bits for Data
- Callsign is sent with each transmission
- Transmissions are routed by callsign

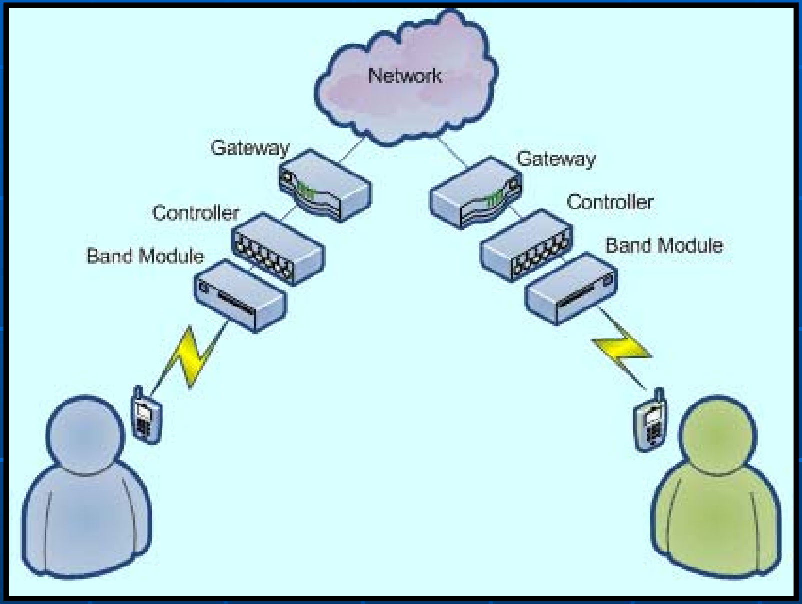
What can D-STAR Do?

- Transmit and receive voice and 1200 baud data simultaneously on 2m, 440 and 1.2 GHz
- 128 Kb data transmission on 1.2 GHz with Internet connectivity (Ethernet bridge to Internet with IP address)
- DPRS (digital APRS) automatic position reporting simultaneous with voice (with optional GPS receiver)
- Flexible repeater linking with Gateway and Internet connections
- Conference bridge (Reflectors) for linking multiple repeaters (over 30 in operation worldwide)
- Connect to other stations regardless of location (callsign routing)

D-STAR Linked QSO

I'm near Seattle, WA.
I'm talking on the
KF7NPL repeater and
my radio is set to

442.67500 +5.000 Mhz



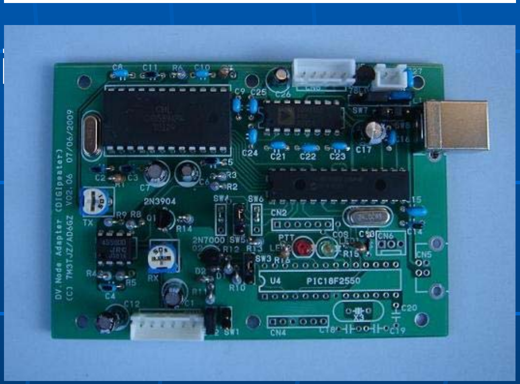
I'm near Tallahassee
FL and I'm listening to
the K4WAK repeater
and my radio is set to
443.95000 +5.000

Mhz

User on Repeater 1 LINKS to USER on Repeater 2

Open Development

- DV Dongle (www.dvdongle.com)
  - Access to D-STAR repeaters via PC without radio
  - Small module connects to PC via USB
  - Uses PC sound card for mic/speaker audio
- Hotspots (www.w9arp.com/hotspot/)
  - Uses GMSK node adapter hardware from Satoshi Yasuda and other clones
  - Connects to 9600 baud packet data port or discriminator of FM radio
- GB7MH Repeater (g4ulf.blogspot.com)
  - Uses GMSK node adapter on Tait T800 repeater
  - Fully tested with US Trust Servers
  - Compatible with all Dplus, DSTARMON, other repeater utilities
- DVAP (dvapdongle.com)
  - DV Access Point Dongle on 2M



D-STAR for EmComm

- Stations can transmit voice and location info simultaneously
- Low and high speed data transfer capability
- Internet access through Gateway-equipped repeaters
- Communicate with stations regardless of location (routing by callsign)
- Versatile repeater linking on the fly
- Repeaters can be connected to reflectors
- Link across states, across the nation, around the world

Typical D-STAR Repeater Stack

D-STAR Reflectors and Nets

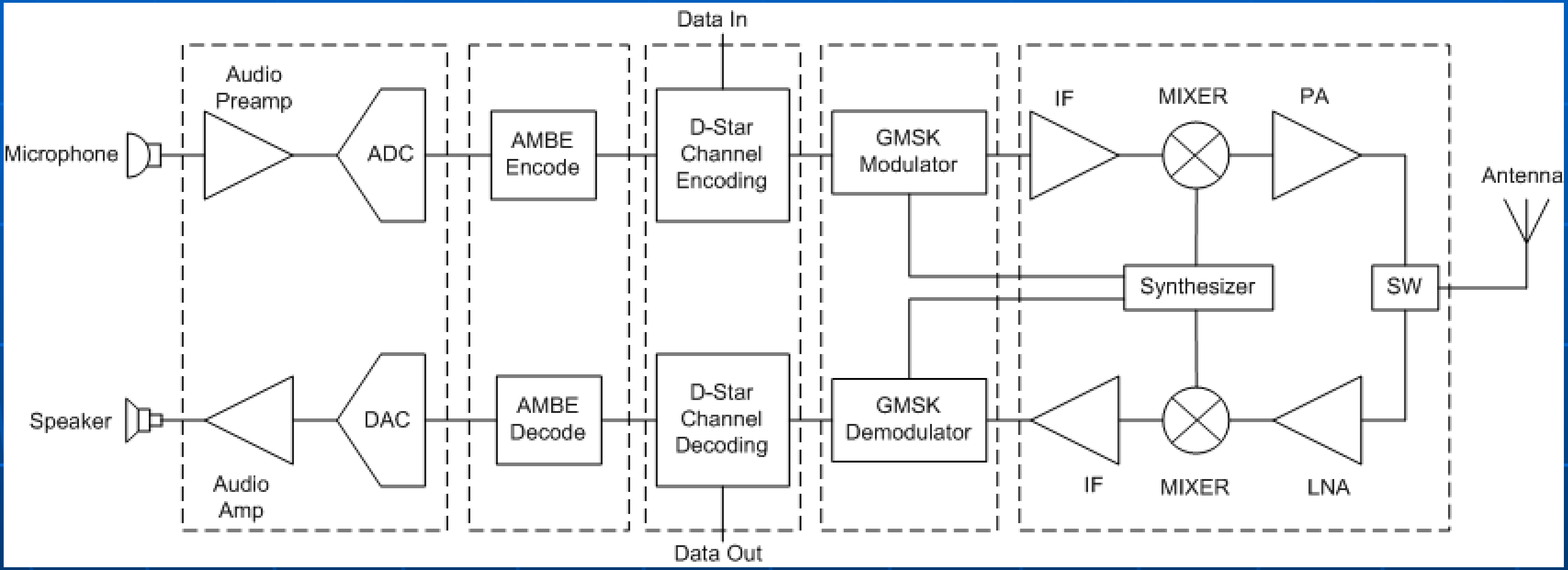
- Over 30 reflectors available worldwide to act as “conference bridges” linking multiple repeaters, Dongle users
- Regional, national and international nets possible with reflectors (over 37 listed on www.dstarinfo.com)
- Linking repeaters to reflectors allows local users to participate with no special programming
- View repeaters/Dongle users connected to reflectors (http://*refnumber*.dstargateway.org/status.html)
- Complete Net listing on www.DSTARinfo.com/reflectors

D-STAR Resources

- View local repeater linked connections, Dongle users, local last heard list at https://callsign.dstargateway.org/status.html
- D-STAR Info Newsletter – published quarterly, available in print or download on Web
- Great D-STAR website, last heard list - www.dstarusers.org
- D-STAR info and calculator – www.dstarinfo.com
- Icom Support Forums

  www.icomamerica.com/en/support/forums
- DV Dongle Info – www.dvdongle.com
- Hotspot– www.w9arp.com/hotspot

D-STAR Under the Covers



D-STAR Under the Covers

- Digital Radio capability—
  - Voice and Data at low speed on any VHF/UHF band
  - Currently implemented on 2M and 70cm
  - High speed data on 1.2 GHz only
  - Capabilities resident in compliant radios and repeaters without need of additional equipment
- Open protocol published in 2001
  - Research funded by Japanese government and administered by the Japanese Amateur Radio League
  - Open to anyone to implement
  - Icom appears to be the lone vendor

D-STAR Under the Covers

- Digital Voice (DV) data stream
  - supports both voice (3600 bps including error correction) and data (1200 bps) on any band
  - RS-232 connection to GPS/computer/PDA
  - Codec for voice uses AMBE® (Advanced Multi-Band Excitation) by DVSI
- Digital Data (DD) data stream
  - 128Kbps only on 1.2 GHZ
  - Ethernet connection
  - Ethernet frames encapsulated in D-Star frames

D-STAR vs Packet

	D-Star	Packet
Voice	3600 bps AMBE (w/FEC)	N/A
Data	DV: 1200 bps DD: 128 kbps	LS: 1200 baud HS: 9600 baud
Bandwidth	DV: 6.25 KHz DD: 130 KHz	20 KHz

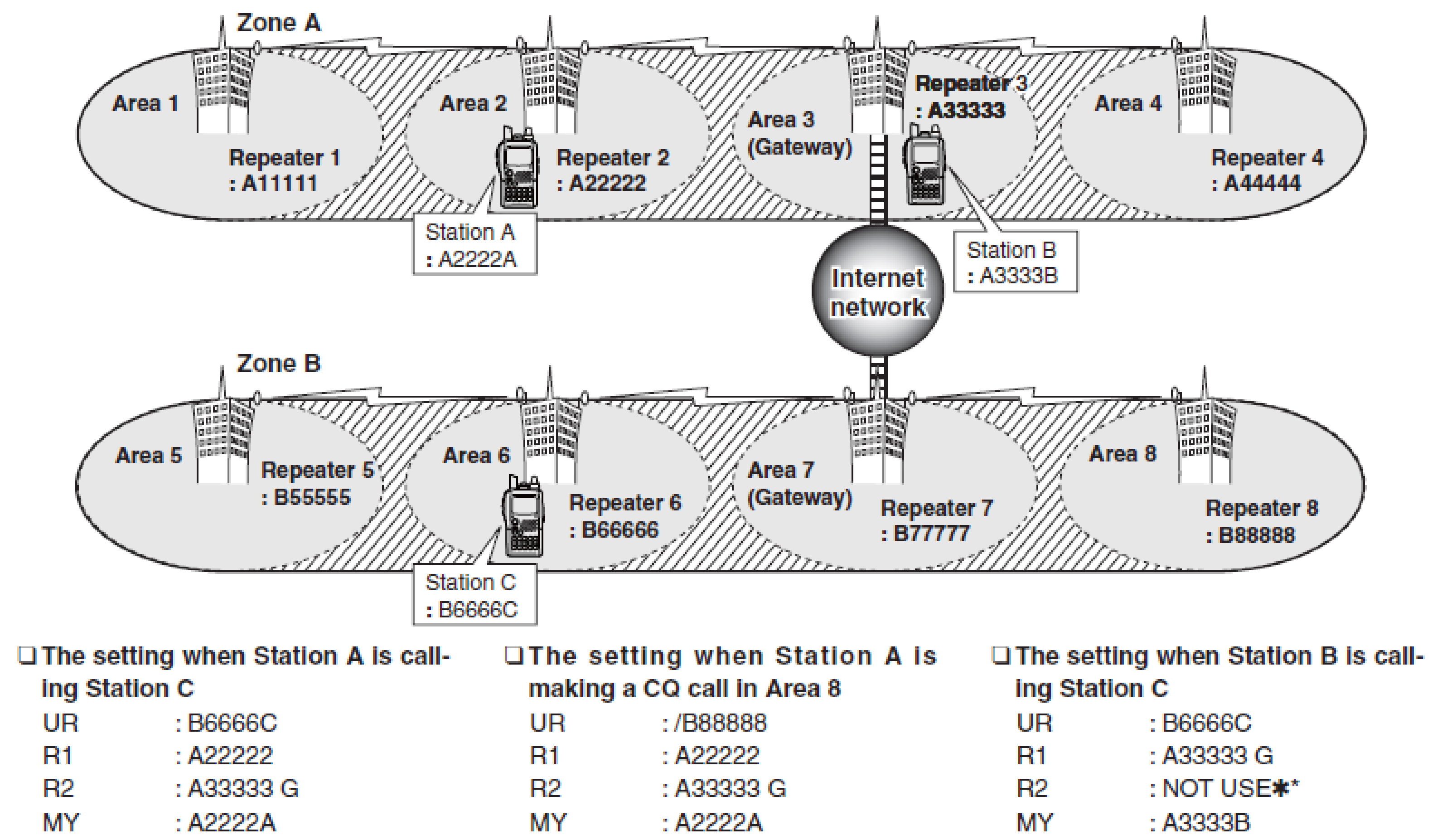
D-STAR vs Packet

	D-Star	Packet
Data Interface	DV: RS-232 DD: Ethernet RJ-45	RS-232
Data Format	DV: Serial 8 bit DD: Encapsulated Ethernet	Serial 8 bit
Airlink	D-Star Bit Stream, GMSK	AX.25 AFSK

D-STAR Call Signs

MY	Originating Station Call	NS7C
UR	CQCQCQ Destination Call Repeater Call Command	CQCQCQ W1XYZ /WA7FW C REF001CL
RPT1	Local Repeater Call and Port	KF7NPL B
RPT2	Gateway Call	KF7NPL G

D-STAR Call Signs



❑ The setting when Station A is calling Station C

UR : B6666C
R1 : A22222
R2 : A33333 G
MY : A2222A

❑ The setting when Station A is making a CQ call in Area 8

UR : /B88888
R1 : A22222
R2 : A33333 G
MY : A2222A

❑ The setting when Station B is calling Station C

UR : B6666C
R1 : A33333 G
R2 : NOT USE✱*
MY : A3333B

D-STAR Repeaters with D-Plus Add On

- Used for Linking Repeaters and Reflectors
  - Uses UR call field
  - Character in 8th position is the command
  - Also used for Information, Echo test, and other scripts
- Examples
  - REF001CL -- Link to Reflector REF001C
  - _______U -- Unlink
  - _______E -- Echo back next transmission
  - _______I -- Send repeater Identification
  - ______xX -- Run script x

Questions?

ircDDB, ircDDBGateway, STARnet Digital, and an Analog Repeater Conversion

A Quick Overview of Some

New and Open Systems

For Use With D-STAR

ircDDB

- Provides near real time updates of callsigns and IP addresses to participating gateways
- Built upon the Internet Relay Chat (irc) protocol
- Fulfills the “promise” of D-STAR where a station is able to move from repeater to repeater and have the network locate a user by Callsign

ircDDB

- Requires software to be added to the gateway
  - Open Source in Java
    - Icom G2 and G4ULF
  - Built-in to ircDDBGateway
- No user action required
  - Users are automatically added to ircDDB on key-up

ircDDB

- Designed, built, and managed by German team
    - DG8NGN – Jann
    - DL5DI – Hans-Jürgen
    - DL1BFF – Michael
    - Team regularly available by email, chat, and VOIP telephony
- Redundant server clusters
    - Europe
    - North America

ircDDB

- Visualization Layer - VIS ON/OFF
  - ircddb.net/live.htm
  - A few Europeans complained that callsigns should be treated as personal privacy data
  - Opt in to have your callsign visible by
    - UR:VIS ON
    - UR:VIS OFF (to mask)

ircDDBGateway and pcrepeatercontroller

- Designed and built by Jonathan – G4KLX
- Supports multiple repeater platforms through pcrepeatercontroller software
  - Icom RP2C controller
  - GMSK modem (USB connected hardware)
  - Soundcard modem (GMSK in software)
  - DummyRepeater

ircDDBGateway

- Does not use or interact with the Trust Server
- Gets all callsign and gateway IP address information directly from ircDDB network
- No registration of users required
  - Talking to stations on Icom G2 and G4ULF requires that callsigns be registered

ircDDBGateway

- Many built-in services
  - DPLUS (Client Only – Like a DVDongle, DVAP, or DVAR Hotspot, it can connect to reflectors and gateways, but other systems cannot connect to it.)
  - DEXTRA (Alternative linking system, modeled after DPLUS, newer generation, uses XRF reflectors, and DEXTRA Gateways)

ircDDBGateway

- Features (continued):
  - Code to avoid DPLUS/DEXTRA cross-linking
  - D-RATS feature
    - login to gateway and run D-RATS out of attached repeater(s) (EOC)
  - DPRS gateway to APRS-IS (GPS-A only)

ircDDBGateway

- Features (continued)
  - Multi-Repeater support (A, B, C, D)
  - No DD mode connection but being investigated
  - Operates with full repeater or simplex radios attached. (Full function replacement for DVAR Hotspot.)
  - Server platform for STARnet Digital
    - Including a bridge to DEXTRA

STARnet Digital

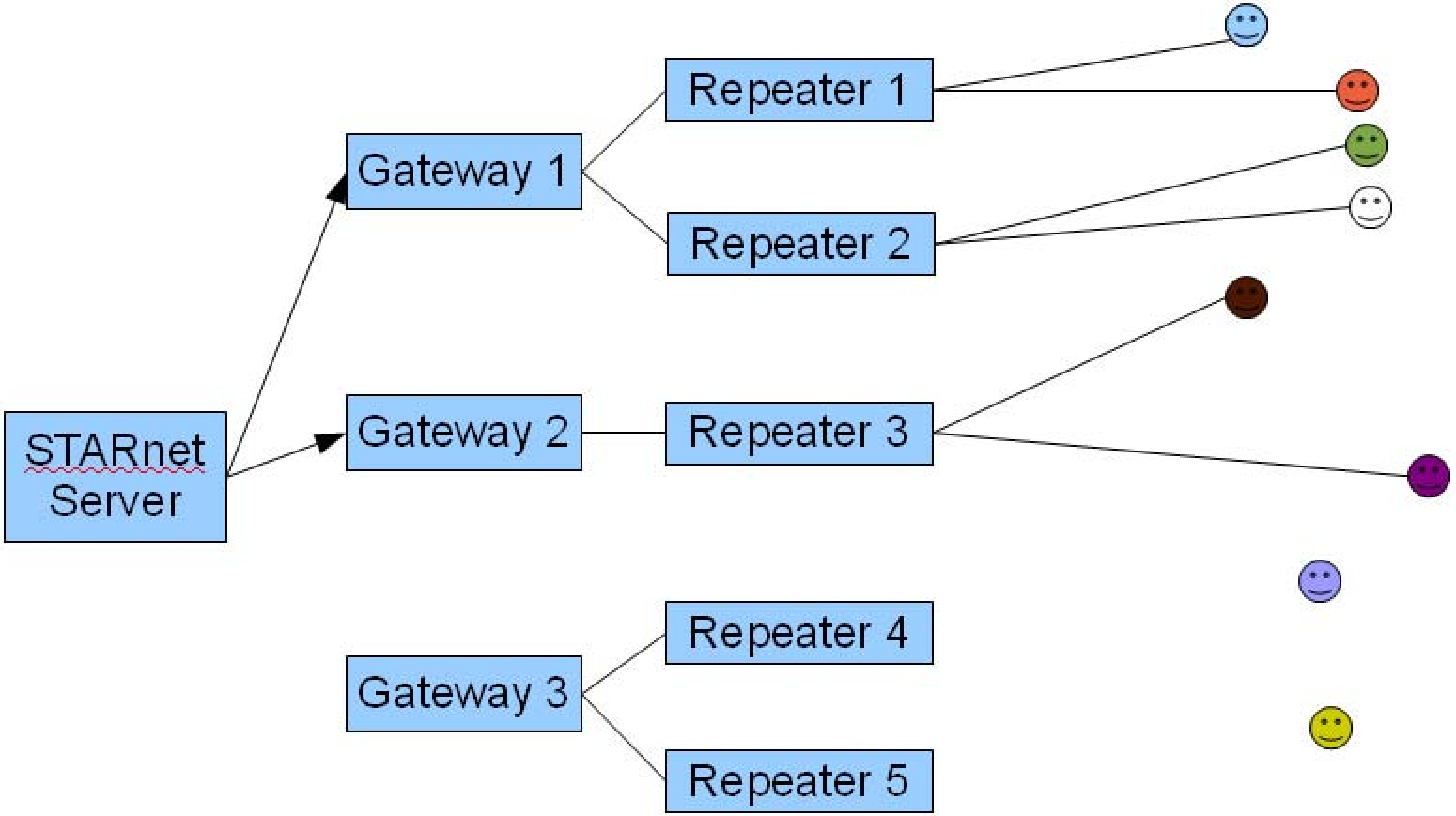
- New application for D-STAR
  - Announced on April 3rd, 2011
- Designed by K7VE and implemented by G4KLX
- It is **not linking** like DPLUS or DEXTRA
- It uses callsign routing to join a network of user stations into a "**group**"

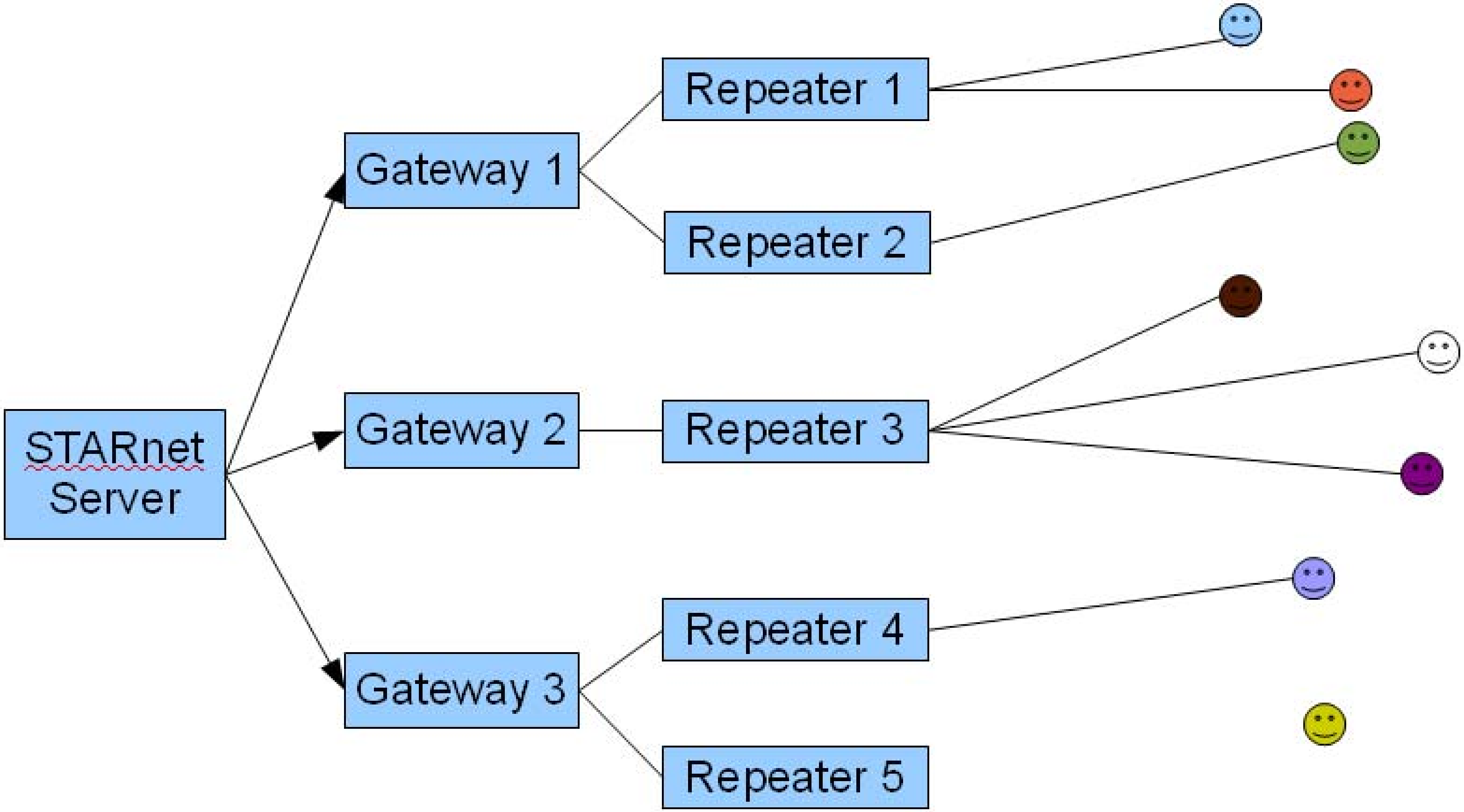
STARnet Digital

- No “unlinking”, no switching to “CQCQCQ”
- To talk to the group, set the group callsign in UR
- If you move to a new repeater
  - The group will follow you once you press PTT
  - The group will leave the old repeater if nobody else is subscribed.
  - Reenter the group callsign to UR to talk to the group (memories are your friends)

STARnet Digital

- To leave a group, put “LOGOFF” in the comment field and put the group call in UR (memories are very handy) and press PTT


STARnet Server
Gateway 1
Gateway 2
Gateway 3
Repeater 1
Repeater 2
Repeater 3
Repeater 4
Repeater 5



STARnet Server

Gateway 1

Gateway 2

Gateway 3

Repeater 1

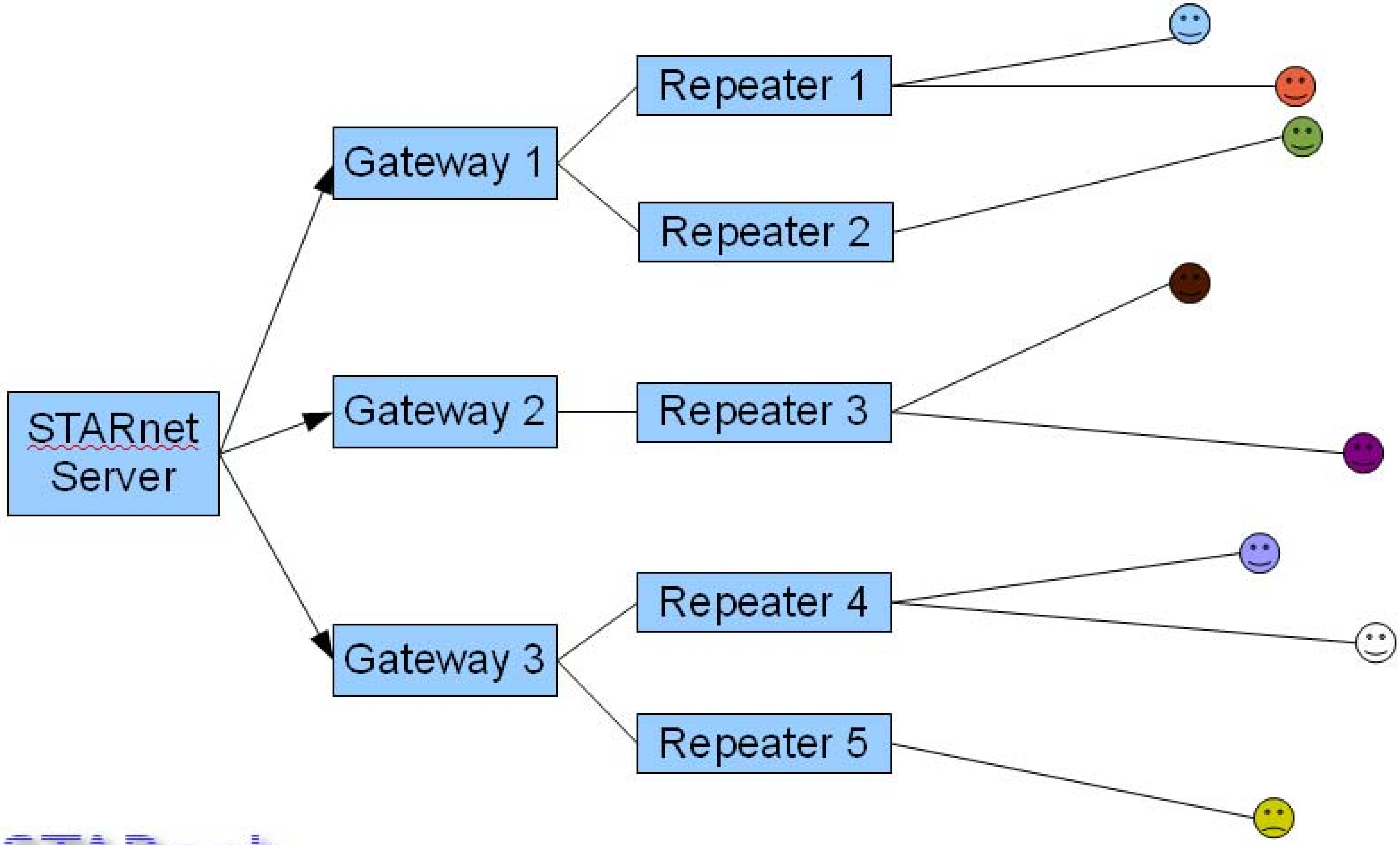
Repeater 2

Repeater 3

Repeater 4

Repeater 5

STARnet Digital



STARnet Server

Gateway 1

Gateway 2

Gateway 3

Repeater 1

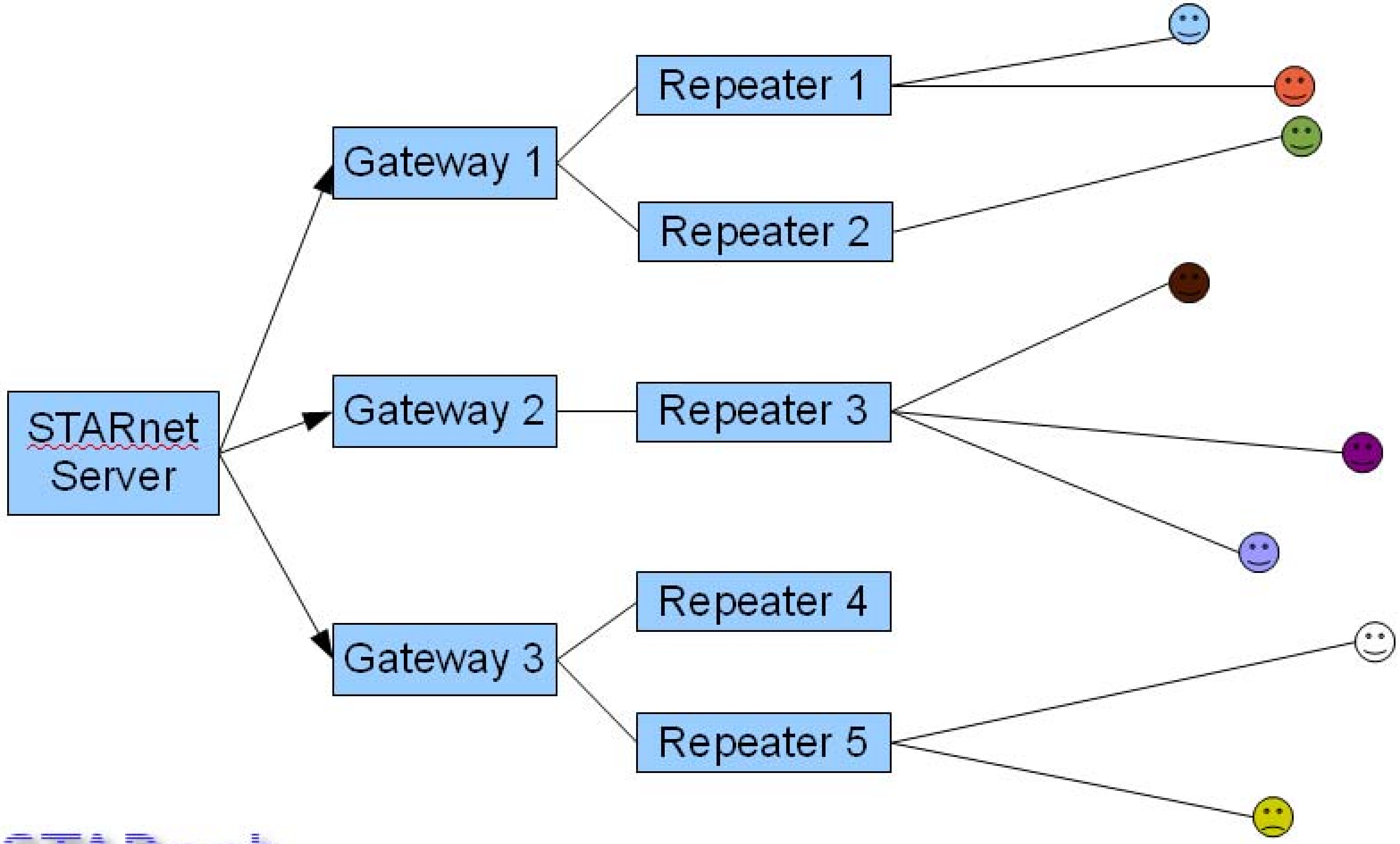
Repeater 2

Repeater 3

Repeater 4

Repeater 5

STARnet
Digital


STARnet Server
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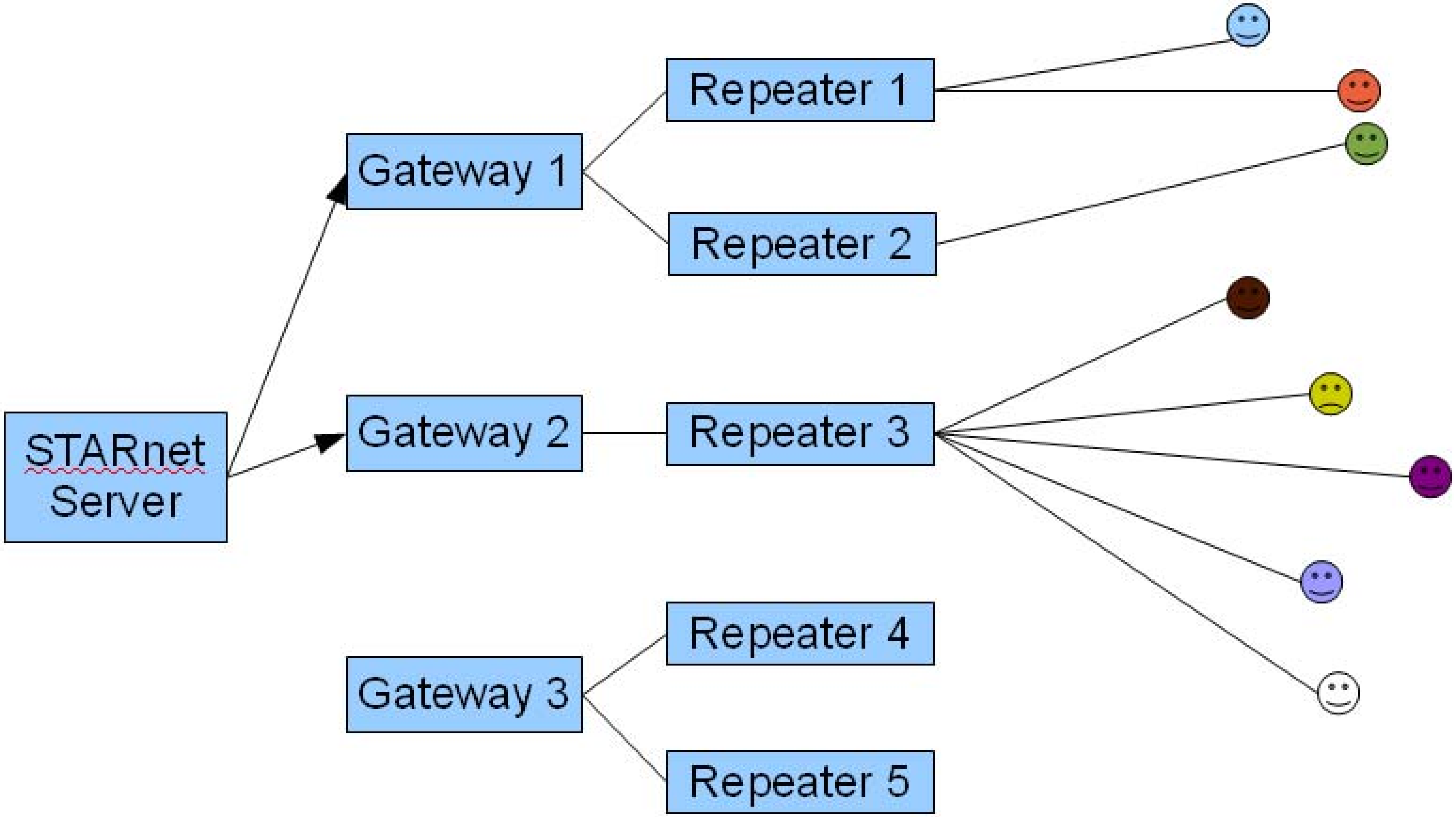

STARnet Server

Gateway 1

Gateway 2

Gateway 3

Repeater 1

Repeater 2

Repeater 3

Repeater 4

Repeater 5

STARnet Digital

STARnet Digital

- The Server
  - Two implementations:
    - ircDDBGateway (if also connecting RF devices such as a repeater or simplex node)
    - Standalone STARnet Server (no RF attached)
  - Needs to have
    - a gateway callsign
    - public IP address (not shared with other gateway)
    - RF attached need a “club” callsign

STARnet Digital

- Each group needs a callsign/terminal ID that is registered on the “trust server”
  - For routing to Icom G2 and G4ULF systems
- Supports up to 10 groups (on STARnet Server) per server.
  - If needed we can increase this number.
- Can run with GUI or as a daemon/service
- Delivered as a Windows binary and

STARnet Digital

- Groups have two timers:
  - A user timer which unsubscribes a station that hasn't keyed up on the group before the timer expires.
  - A group timer which unsubscribes all users in the group if it expires and no station has transmitted to the group
  - Each timer is in minutes and can be set to never expire (except on reboot of the group)

STARnet Digital

- Stations can subscribe to multiple groups
  - Subscribe then go about your regular operating, when traffic is sent to the group(s) it will appear on the repeater/simplex node you last transmitted on.
    - The gateway must have ircDDB enabled.
  - Unsubscribe from groups that you are no longer interested in

STARnet Digital

- Powerful tool for EMCOMM as you can create separate groups for each team, such as:
  - State wide
  - County wide
  - Municipality wide
  - Tactical team
- Change UR callsign to talk to each group

- Change UR callsign to [illegible] when

STARnet Digital

- Still adding features, but it is ready to go for you to use.
- More information:
  - Yahoo! Forum ircDDBGateway
  - Yahoo! Forum pcrepeatercontroller
  - My blog at k7ve.org
    - See Press Announcement
    - More articles to come

An Analog Repeater Conversion

- Converting an analog repeater can be easy or hard, depending on selected repeater.
  - Repeater must use true FM (not PM)
  - Access discriminator audio for receive
  - Access to modulator modulation point
  - PTT (COR optional)

An Analog Repeater Conversion

- Additional Items:
  - Modem board (mini-Hotspot and firmware), cheap soundcard, or Icom controller (with interface circuit)
  - Computer with pcrepeatercontroller or G4ULF repeater software and gateway software.

An Analog Repeater Conversion

- Adjust deviation to approximately 1.2 Khz
- If possible replace receive filters to obtain narrow band receive (6.25 Khz. Signal)
- Make sure audio in and out is flat, this may require removing some parts. GMSK has many low “audio” components (near 0 Hz.)

An Analog Repeater Conversion

- Adjust levels for proper modulation mask.
- Everything else about good repeater design:
  - low loss (hardline) coax, good duplexers, etc.
- I use a narrowbanded Kenwood TKR-820
  - See k7ve.org blog

Questions?

Visit http://k7ve.org
Email k7ve@k7ve.org

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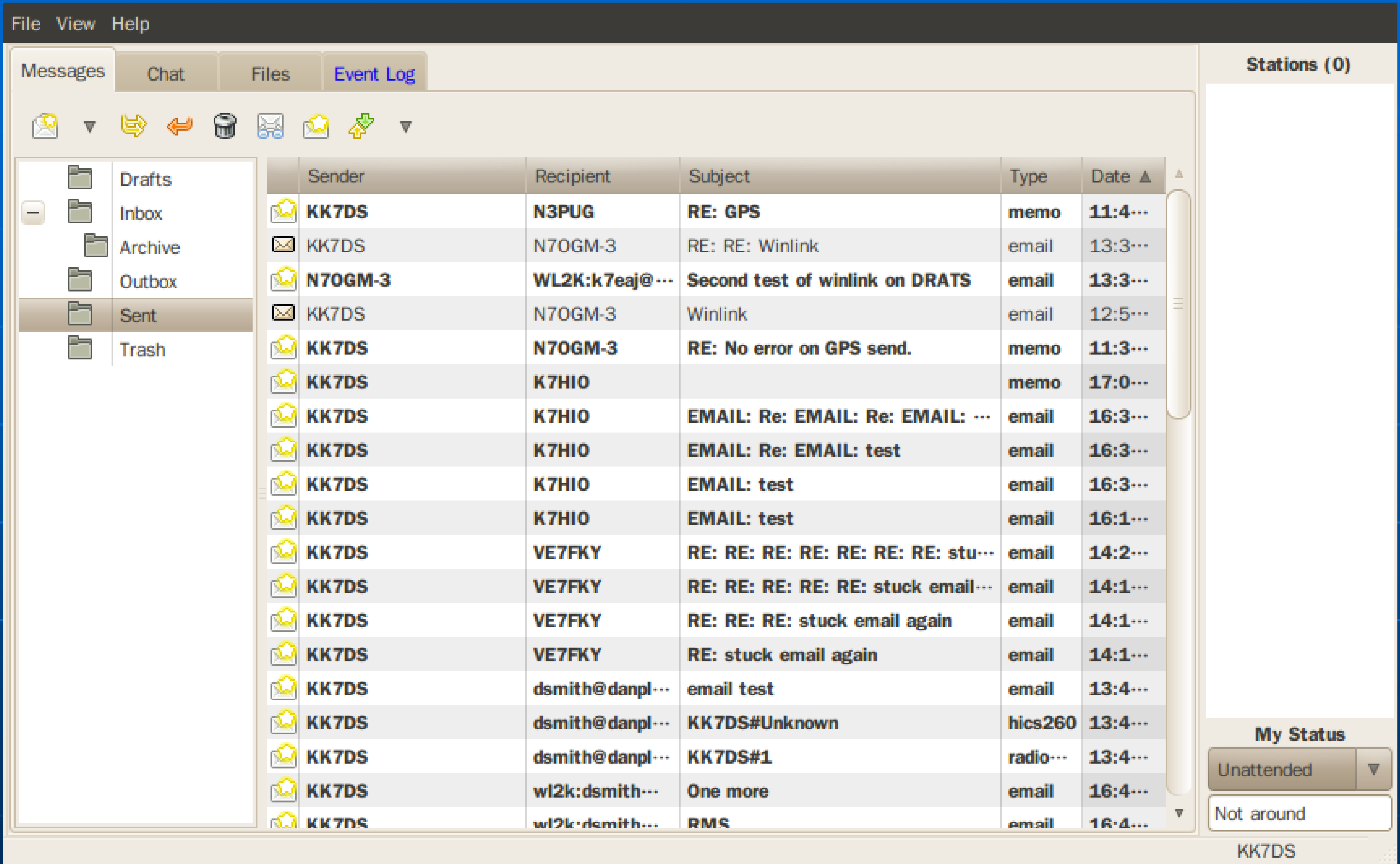
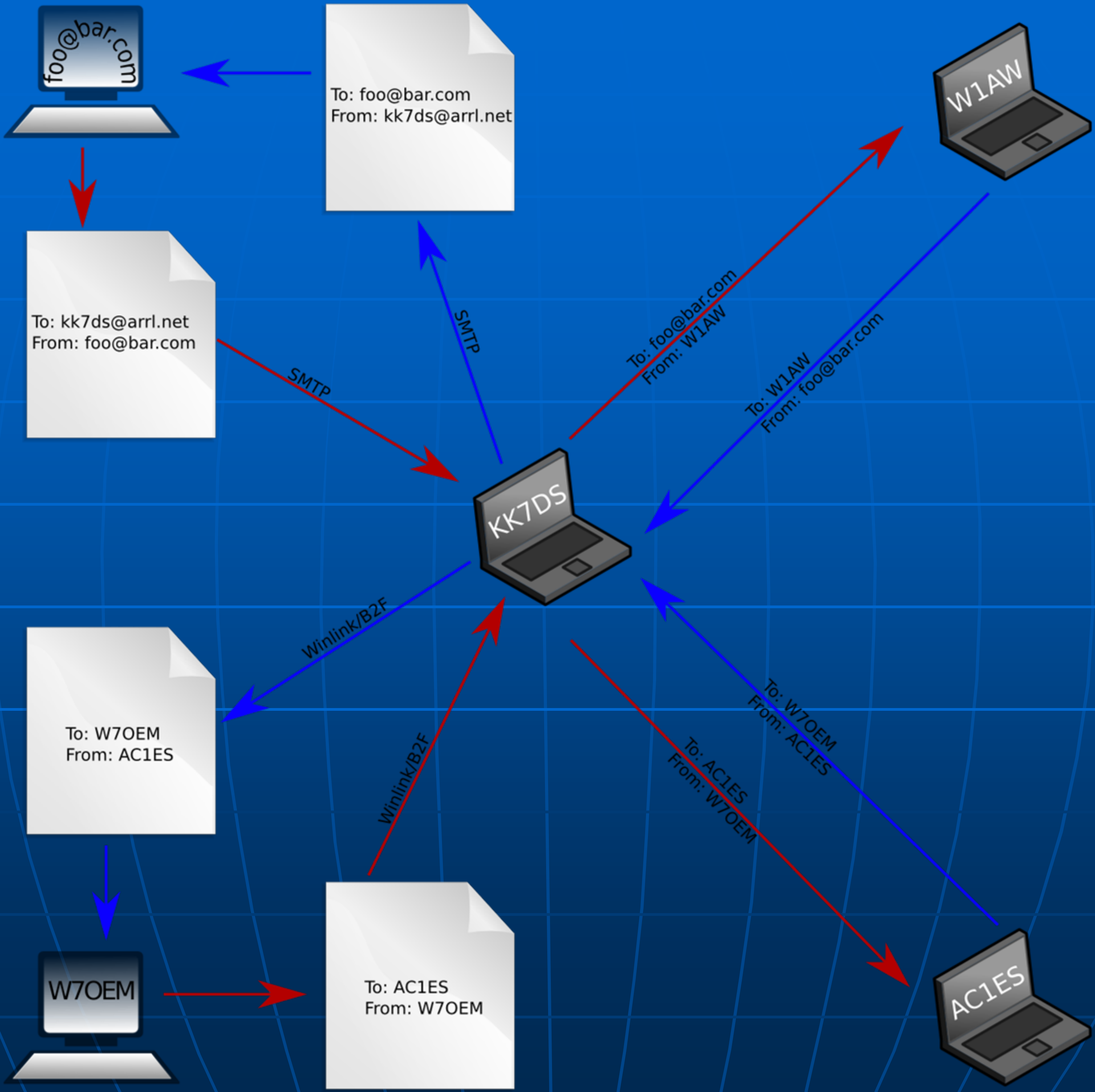


Sender	Recipient	Subject	Type	Date ▲
KK7DS	N3PUG	RE: GPS	memo	11:4···
KK7DS	N7OGM-3	RE: RE: Winlink	email	13:3···
N7OGM-3	WL2K:k7eaj@···	Second test of winlink on DRATS	email	13:3···
KK7DS	N7OGM-3	Winlink	email	12:5···
KK7DS	N7OGM-3	RE: No error on GPS send.	memo	11:3···
KK7DS	K7HIO		memo	17:0···
KK7DS	K7HIO	EMAIL: Re: EMAIL: Re: EMAIL: ···	email	16:3···
KK7DS	K7HIO	EMAIL: Re: EMAIL: test	email	16:3···
KK7DS	K7HIO	EMAIL: test	email	16:3···
KK7DS	K7HIO	EMAIL: test	email	16:1···
KK7DS	VE7FKY	RE: RE: RE: RE: RE: RE: RE: stu···	email	14:2···
KK7DS	VE7FKY	RE: RE: RE: RE: RE: stuck email···	email	14:1···
KK7DS	VE7FKY	RE: RE: RE: stuck email again	email	14:1···
KK7DS	VE7FKY	RE: stuck email again	email	14:1···
KK7DS	dsmith@danpl···	email test	email	13:4···
KK7DS	dsmith@danpl···	KK7DS#Unknown	hics260	13:4···
KK7DS	dsmith@danpl···	KK7DS#1	radio···	13:4···
KK7DS	wl2k:dsmith···	One more	email	16:4···
KK7DS	wl2k:dsmith···	RMS	email	16:4···

Not around

D-RATS Messaging

- Standard Inbox, Outbox, Drafts, Sent folders
- Messages destined for local hit the Inbox
- Anything for another station goes to the Outbox
  - Outbox becomes a queue
  - Newly heard stations trigger message send
  - Internet (SMTP, WL2K) messages go immediately
- D-RATS provides SMTP/POP3 gateway
  - Easy masquerading function
  - POP3 gateway option
  - Winlink function is more transparent, both ways



foo@bar.com

To: foo@bar.com
From: kk7ds@arrl.net

W1AW

To: kk7ds@arrl.net
From: foo@bar.com

SMTP

SMTP

To: foo@bar.com
From: W1AW

To: W1AW
From: foo@bar.com

KK7DS

Winlink/B2F

To: W7OEM
From: AC1ES

Winlink/B2F

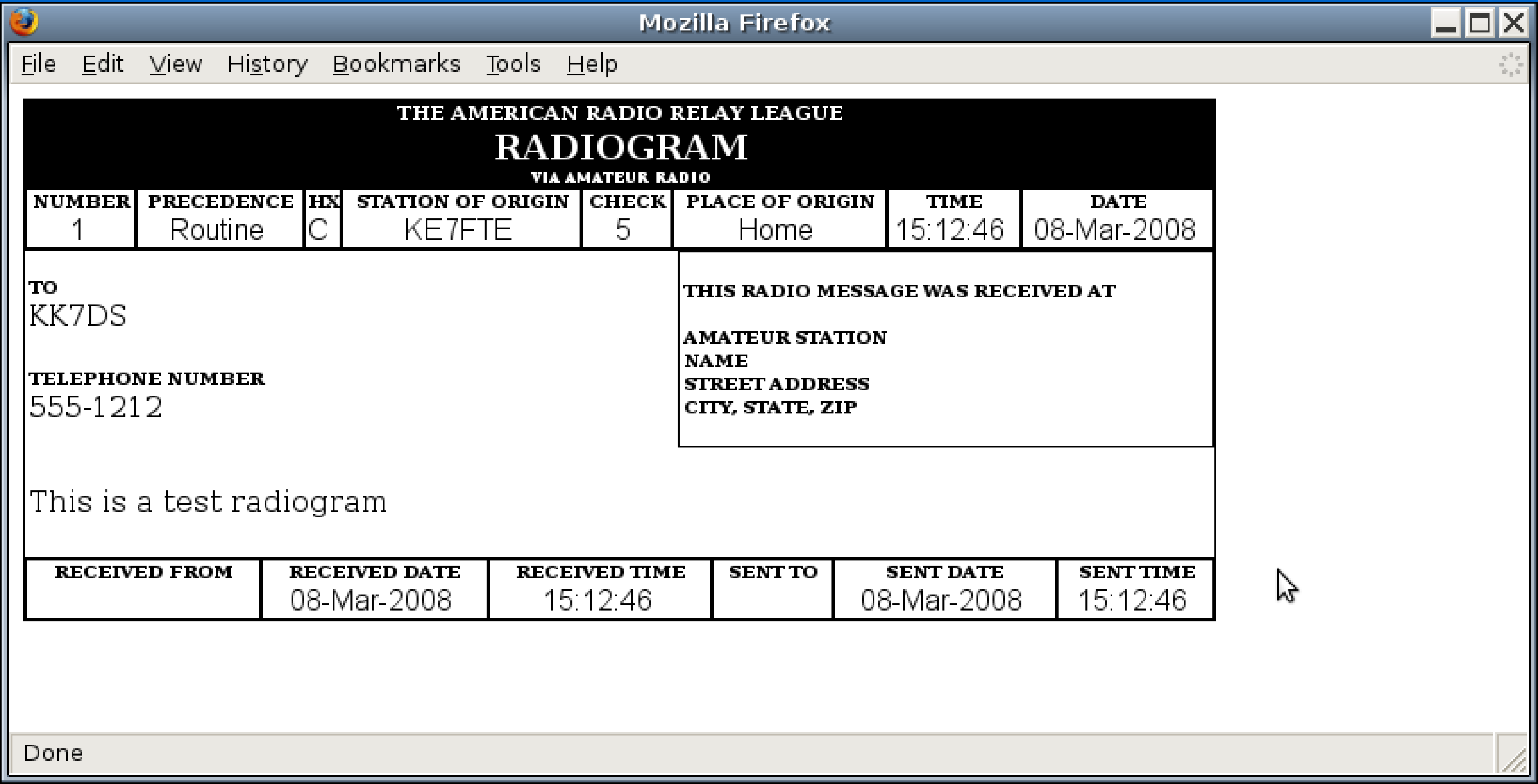
To: W7OEM
From: AC1ES

To: AC1ES
From: W7OEM

W7OEM

To: AC1ES
From: W7OEM

AC1ES



THE AMERICAN RADIO RELAY LEAGUE

RADIOGRAM

VIA AMATEUR RADIO

NUMBER	PRECEDENCE	HX	STATION OF ORIGIN	CHECK	PLACE OF ORIGIN	TIME	DATE
1	Routine	C	KE7FTE	5	Home	15:12:46	08-Mar-2008

TO
KK7DS

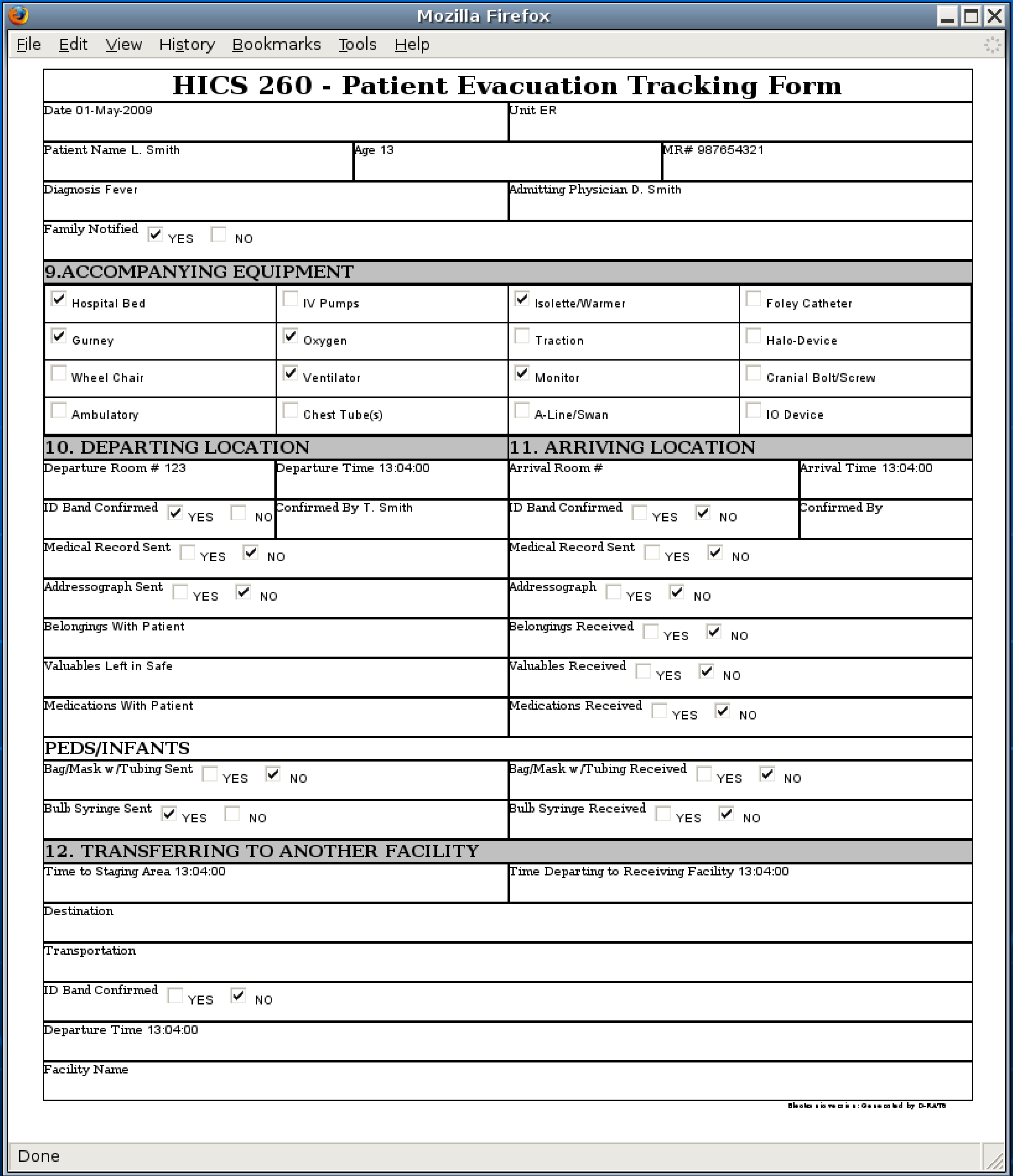
TELEPHONE NUMBER
555-1212

THIS RADIO MESSAGE WAS RECEIVED AT

AMATEUR STATION
NAME
STREET ADDRESS
CITY, STATE, ZIP

This is a test radiogram

RECEIVED FROM	RECEIVED DATE	RECEIVED TIME	SENT TO	SENT DATE	SENT TIME
	08-Mar-2008	15:12:46		08-Mar-2008	15:12:46



HICS 260 - Patient Evacuation Tracking Form

Date 01-May-2009	Unit ER	
Patient Name L. Smith	Age 13	MR# 987654321
Diagnosis Fever	Admitting Physician D. Smith	

Family Notified ☑ YES ☐ NO

9.ACCOMPANYING EQUIPMENT

☑ Hospital Bed	☐ IV Pumps	☑ Isolette/Warmer	☐ Foley Catheter
☑ Gurney	☑ Oxygen	☐ Traction	☐ Halo-Device
☐ Wheel Chair	☑ Ventilator	☑ Monitor	☐ Cranial Bolt/Screw
☐ Ambulatory	☐ Chest Tube(s)	☐ A-Line/Swan	☐ IO Device

10. DEPARTING LOCATION		11. ARRIVING LOCATION	
Departure Room # 123	Departure Time 13:04:00	Arrival Room #	Arrival Time 13:04:00
ID Band Confirmed ☑ YES ☐ NO	Confirmed By T. Smith	ID Band Confirmed ☐ YES ☑ NO	Confirmed By
Medical Record Sent ☐ YES ☑ NO		Medical Record Sent ☐ YES ☑ NO	
Addressograph Sent ☐ YES ☑ NO		Addressograph ☐ YES ☑ NO	
Belongings With Patient		Belongings Received ☐ YES ☑ NO	
Valuables Left in Safe		Valuables Received ☐ YES ☑ NO	
Medications With Patient		Medications Received ☐ YES ☑ NO	

PEDS/INFANTS

Bag/Mask w/Tubing Sent ☐ YES ☑ NO	Bag/Mask w/Tubing Received ☐ YES ☑ NO
Bulb Syringe Sent ☑ YES ☐ NO	Bulb Syringe Received ☐ YES ☑ NO

12. TRANSFERRING TO ANOTHER FACILITY

Time to Staging Area 13:04:00	Time Departing to Receiving Facility 13:04:00

Destination

Transportation

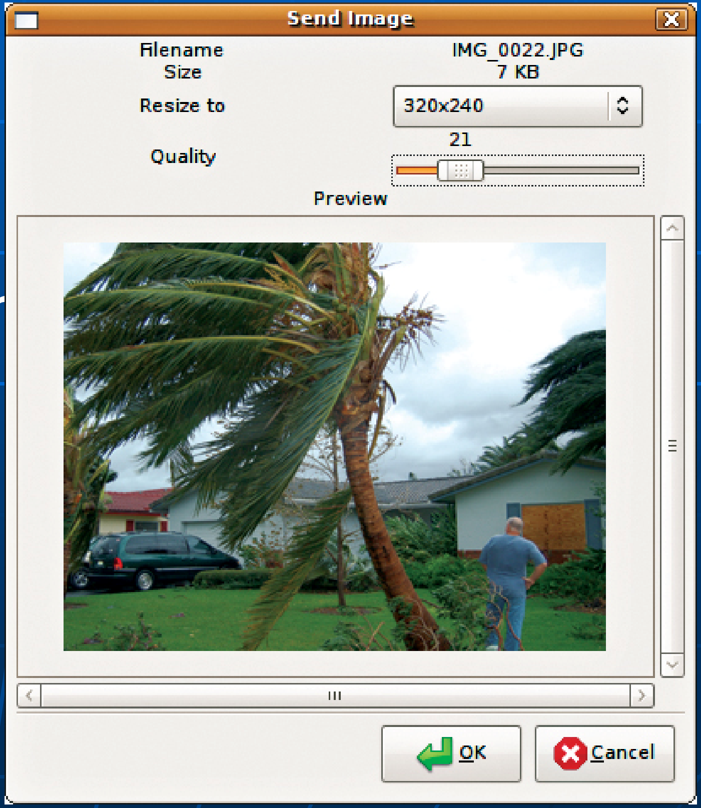
ID Band Confirmed ☐ YES ☑ NO

Departure Time 13:04:00

Facility Name

Files and Images

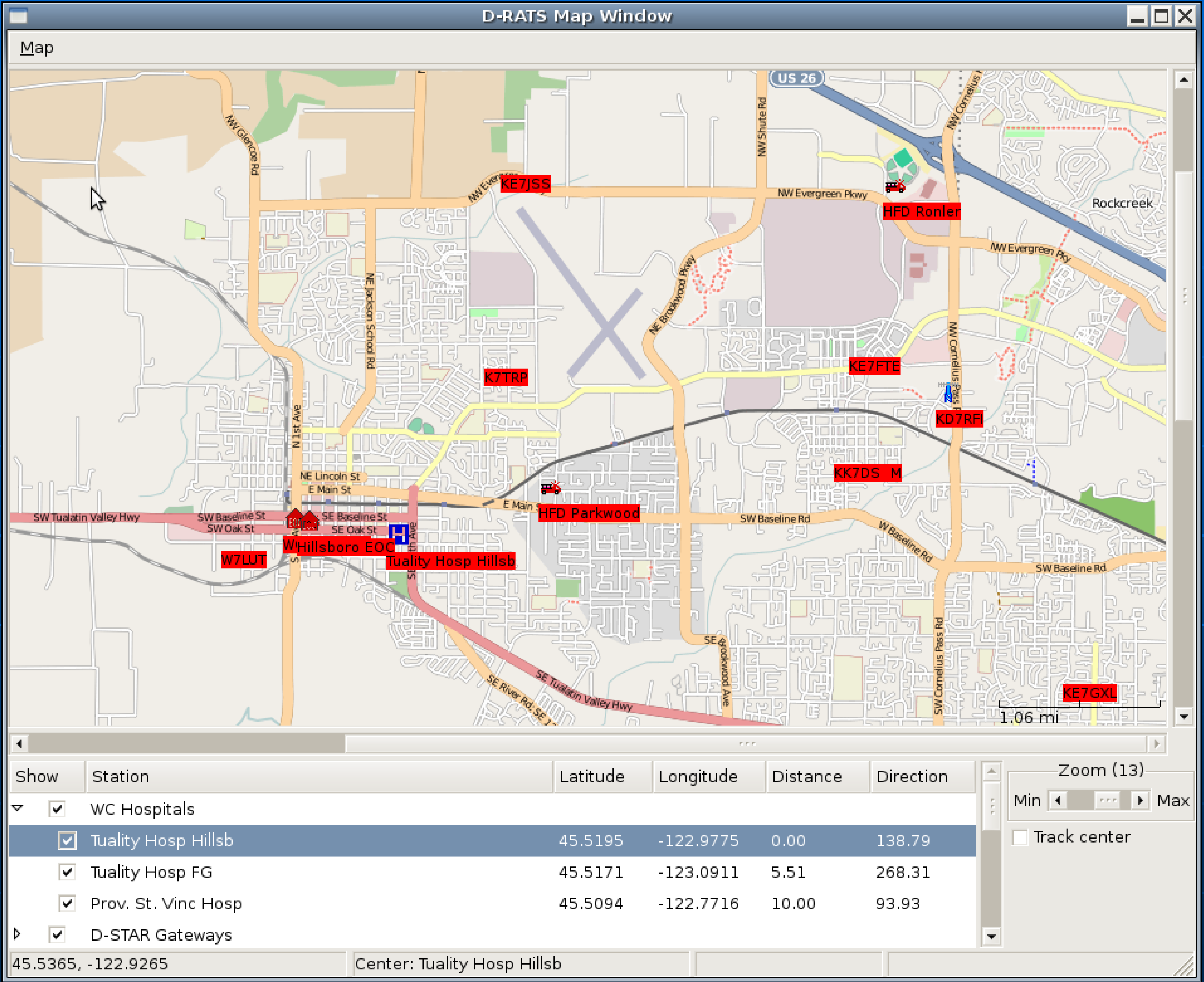
- Arbitrary file transfers with sliding window, compression, and resume
- “File server” for remote retrieval
- Integrated resize/resam of image files
- Block size and window scaling



Filename IMG_0022.JPG
Size 7 KB
Resize to 320x240
Quality 21

Integrated Mapping

- Free maps automatically downloaded from the network
- DPRS icon support
- Real-time positions from moving stations
- Additional dynamic information overlays

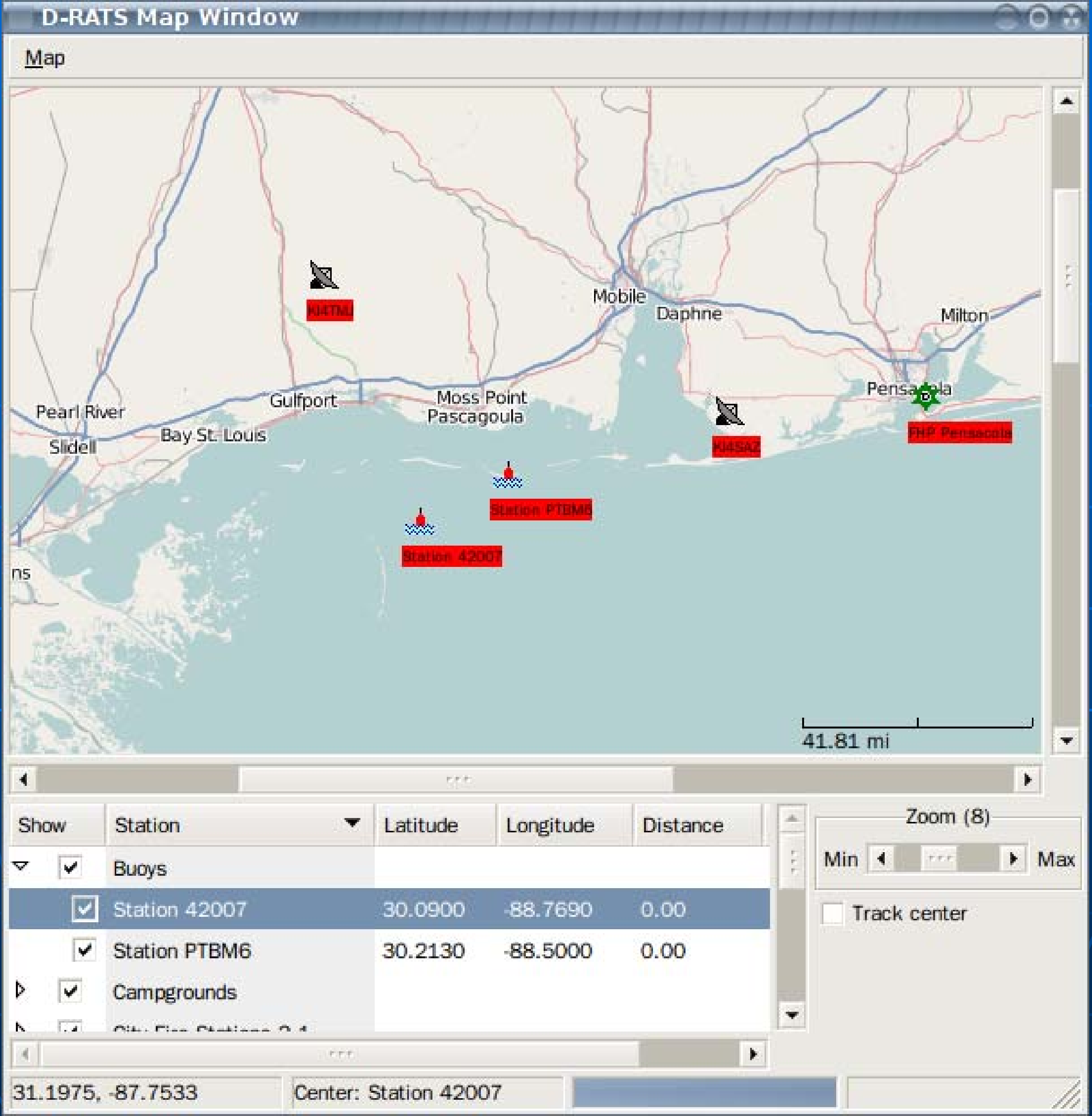


Show	Station	Latitude	Longitude	Distance	Direction
☑	WC Hospitals				
☑	Tuality Hosp Hillsb	45.5195	-122.9775	0.00	138.79
☑	Tuality Hosp FG	45.5171	-123.0911	5.51	268.31
☑	Prov. St. Vinc Hosp	45.5094	-122.7716	10.00	93.93
☑	D-STAR Gateways				

☐ Track center

45.5365, -122.9265

Center: Tuality Hosp Hillsb

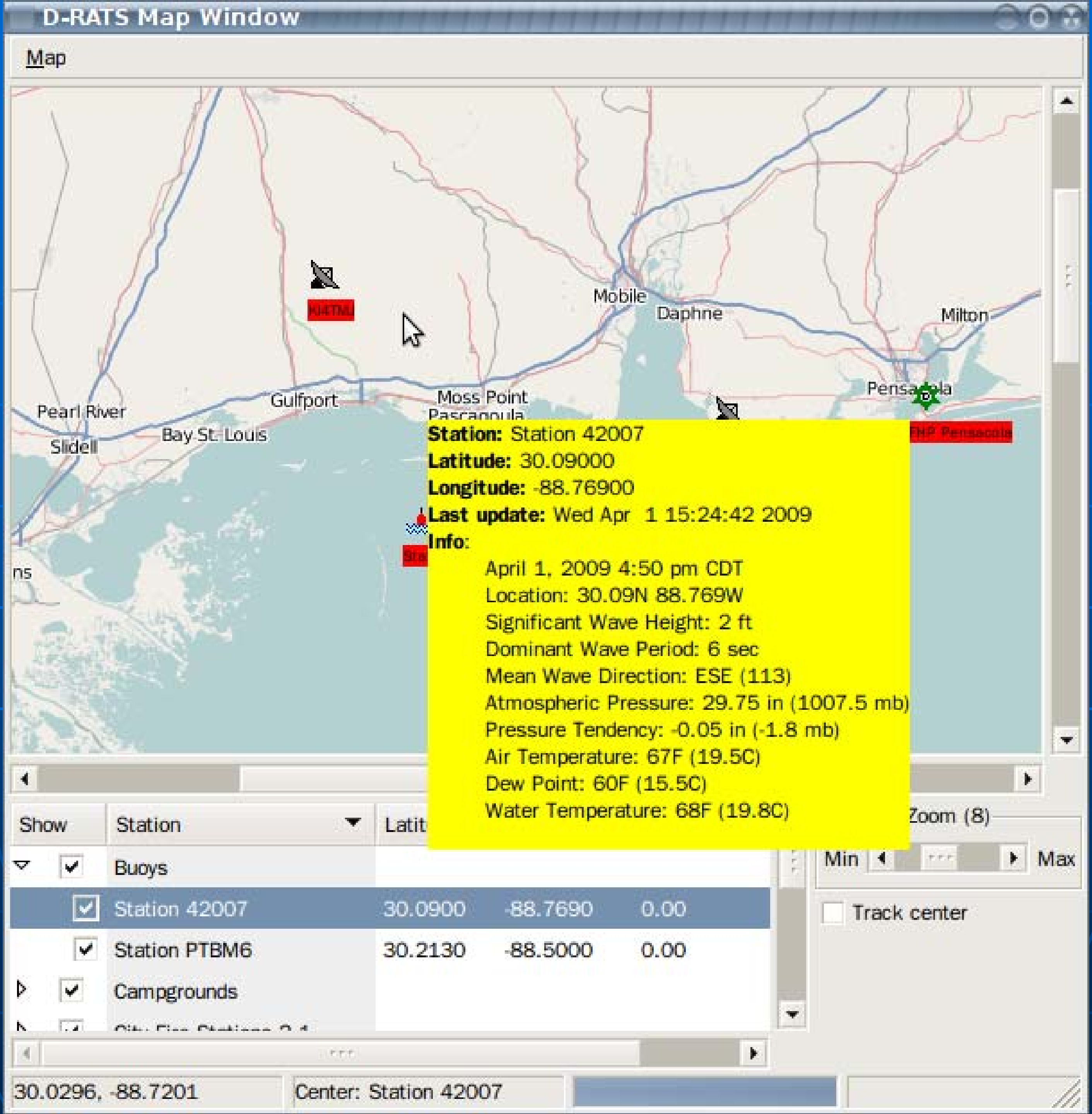


Show	Station	Latitude	Longitude	Distance
▽ ☑	Buoys			
☑	Station 42007	30.0900	-88.7690	0.00
☑	Station PTBM6	30.2130	-88.5000	0.00
▷ ☑	Campgrounds			

☐ Track center

31.1975, -87.7533

Center: Station 42007



Station: Station 42007
Latitude: 30.09000
Longitude: -88.76900
Last update: Wed Apr 1 15:24:42 2009
Info:
April 1, 2009 4:50 pm CDT
Location: 30.09N 88.769W
Significant Wave Height: 2 ft
Dominant Wave Period: 6 sec
Mean Wave Direction: ESE (113)
Atmospheric Pressure: 29.75 in (1007.5 mb)
Pressure Tendency: -0.05 in (-1.8 mb)
Air Temperature: 67F (19.5C)
Dew Point: 60F (15.5C)
Water Temperature: 68F (19.8C)

Show	Station	Latit		
☑	Buoys			
☑	Station 42007	30.0900	-88.7690	0.00
☑	Station PTBM6	30.2130	-88.5000	0.00
☑	Campgrounds			

30.0296, -88.7201
Center: Station 42007

Questions?